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Specification and Drawings, as originally filed, with Application for Patent Serial No: **2,286,881,** on October 15, 1999, by **FANTOM TECHNOLOGIES INC.,** assignee of Wayne Ernest Conrad, for "Method and Apparatus for Increasing the Power Output of Primary and Secondary Batteries".

CA00/01183

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L. Rejmbal
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## ABSTRACT OF THE DISCLOSURE

A method and apparatus are provided for optimizing power drawn from primary or secondary cells. This is achieved by providing a pulse train. A first pulse train, optimized for the battery, can further be modified to generate a second pulse train, optimized for a particular load.

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BERESKIN & PARR

CANADA

# Title: METHOD AND APPARATUS FOR INCREASING THE POWER OUTPUT OF PRIMARY AND SECONDARY BATTERIES

Inventors: Wayne Ernest Conrad

# Title: METHOD AND APPARATUS FOR INCREASING THE POWER OUTPUT OF PRIMARY AND SECONDARY BATTERIES

## FIELD OF THE INVENTION

This invention relates primary and secondary cells for batteries, and more particularly is concerned with increasing the total amount of energy from such cell.

## BACKGROUND OF THE INVENTION

There are many applications today in which electric motors and other devices are powered by batteries or cells. Batteries or cells are commonly classified into types, namely: primary cells, which are single use cells and that after discharge cannot be recharged for further use; and secondary cells or batteries, which are subjected to a large number of charge and discharge cycles.

Commonly, the current or energy drain from a battery or cell, whether this be a primary cell or secondary cell, is determined solely by the characteristics of the load. In many cases, the load is an electric motor, and electric motors for pumping gases and fluids account for one-quarter of all the electricity consumed in the world today. There are a number of concepts employing pulse width modulation, which are used to control the power consumption of electric motors. These have had some modest success. However, these known techniques are directed solely to controlling the motor, without regard to the effect on the energy source, and in particular without regard to any impact on the drain from a battery source.

## SUMMARY OF THE INVENTION

What the present inventor has realized is that it is possible to devise an optimum wave form, to increase or to optimize the power or energy output of primary and secondary batteries. More particularly, research by the inventor has shown that discharging a battery with a wave form comprising a pulse train, can give enhanced performance.

This is achieved by developing an algorithm relating the power or energy obtained from the battery to key parameters of the pulse train, namely, voltage, frequency and pulse width. Then, one or more, preferably two or more of these parameters (voltage, frequency and pulse width) are optimized for a particular load, to improve the performance of the battery.

## BRIEF DESCRIPTION OF THE DRAWING FIGURES

For a better understanding of the present invention and to show more clearly how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 shows a schematic view of an apparatus in accordance with the present invention; and

Figure 2 is a graph showing one period of a typical pulse train.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figure 1, an apparatus in accordance with the present invention has a battery holder or connector 1, here shown connected to a pair of batteries or cells 2. It will be understood that, in known manner, either a single battery could be provided or two or more batteries could be provided, connected either in parallel or in series. Additionally, as already noted, the batteries could be either primary cells or secondary cells.

The battery connector 1 is connected by wires 3 to an electronic control unit 4. This electronic control unit 4 imparts a pulse wave form to the current drawn from the batteries 2. The electronic control unit 4 itself takes power necessary for its operation from the batteries 2, but the additional load is minimal, and much less than any power saving achieved.

Figure 1 also shows a second electronic control unit 6 connected by wires 5 to the first electronic control unit 4. This unit is intended, in this particular embodiment, to further attenuate the signal, to

make it suitable for the desired load. For some applications, this second electronic control unit 6 could be omitted.

The load for this embodiment is an electric motor, indicated at 8 and connected by wires 7 to the second electronic control unit 6.

Conventionally, the motor 8 would simply draw a relatively constant current from the batteries 2. In the present invention, the control unit 4 serves to modulate this current drain to give a pulsed wave form. The effect of this is not fully understood. It is believed that a constant DC current results in much of the charge being drawn at less than optimal conditions.

On an atomic level, it is believed that there is some resonant effect, and that for each individual charge drawn from the battery, there is some optimal state for doing this. For a constant DC current, much of the charge is drawn at less than an optimal state. When pulses are provided, it is believed that a relaxation period following each pulse, ensures that during each pulse all or most of the charge is drawn at an optimal state. This reduces the losses and leads to more efficient recovery of energy stored in the battery or cell.

Figure 2 shows exemplary pulse wave forms over a period 20. Within this period 20, there are 5 individual pulses, labelled 21, 22, 23, 24 and 25. Following each pulse, there is a respective pulse interval, labelled at 21a, 22a, 23a, 24a and 25a. In this example, these intervals have the parameters given in the following table and shown in the drawing.

**TABLE 1**

| Pulse Number | Pulse Voltage | Pulse Duration | Pulse Interval |
|---|---|---|---|
| 21 | 1.3 | 0.7 | 4 ms |
| 22 | 1.4 | 0.8 | 5 ms |
| 23 | 1.5 | 0.9 | 6 ms |
| 24 | 1.6 | 0.1 | 7 ms |
| 25 | 1.9 | 0.2 | 10 ms |

It is to be appreciated also that the second electronic unit 6 is provided to account for different characteristics of the load, whether this be a motor 8 or some other load. Thus, the first electronic control unit 8 provides a pulse train optimized for the characteristics of the batteries 2. The power supply to the wires 5 can then simply be taken as a power source by the electronic control unit 6, and a different pulse train supplied to the motor 8 or other load. For example, as indicated above, to discharge a battery, a relatively low frequency pulse train is required. For other applications, a much higher frequency pulse train may be required. In applicant's copending and simultaneously filed application, an example is given of powering an incandescent light bulb. For this application, a very high frequency pulse train is required.

**CLAIMS:**

1. A method of extracting power from a battery (either a primary or secondary battery), the method comprising:

(1) taking current from the battery as a train of pulses;

(2) selecting at least one parameter from the group comprising frequency, voltage height and pulse width, for the pulse train, to optimize energy drawn from the battery.

2. An apparatus for optimizing energy drawn from a battery, the apparatus comprising:

means for providing a connection to a battery (either a primary or secondary batter);

a first electronic control unit connected to the connector means and for generating a pulse train, whereby energy is drawn from the batter as a train of pulses.

3. An apparatus as claimed in claim 2, which includes a second electronic control unit, for receiving power from the first electronic control unit and for converting the first pulse train into a second pulse train adapted to optimize performance of a load to which the second electronic control unit is connected, wherein for each pulse train, at least one parameter, selected from frequency, voltage and pulse width, is modified, to optimize performance.

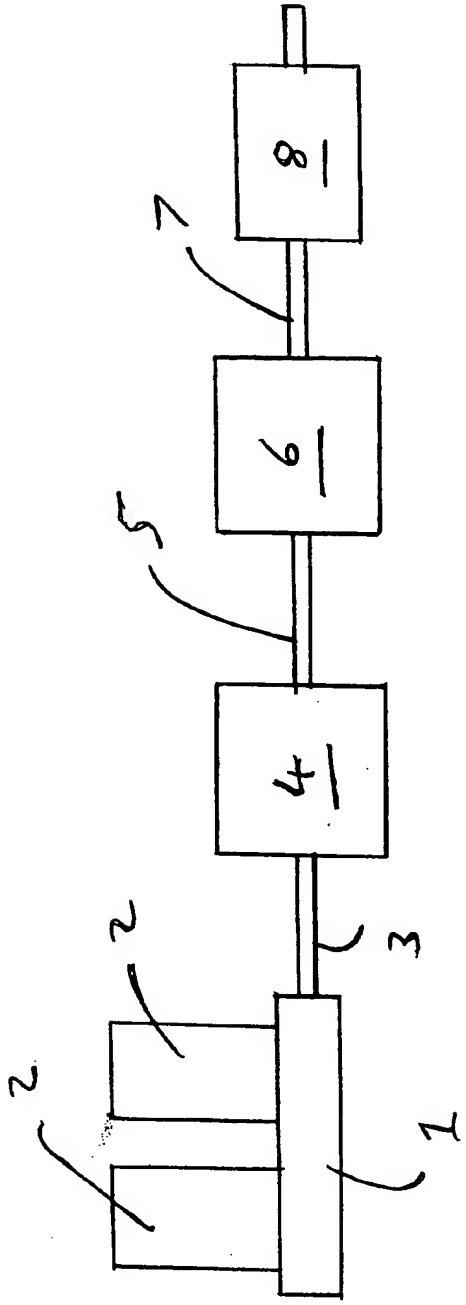


Figure 1